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Mazdoor Kisan Shakti Sangathan

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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 6231 (1971): Prismatic Angle Gauges [PGD 25: Engineering Metrology]

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”



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Indian Standard
**SPECIFICATION FOR
PRISMATIC ANGLE GAUGES**

1. Scope — Lays down requirements for prismatic angle gauges.

1.1 These angle gauges together with the square block may be used to obtain any angle between 0 and 360 degrees in steps of 6 seconds.

2. Material — The material of the gauges shall be suitable gauge steel which has the properties of ageing stability in dimensions and wear resistance. Suitable examples of steels from IS : 1570-1961 'Schedules for wrought steels for general engineering purposes', are given below:

<i>Sl No.</i>	<i>Designation</i>	<i>Schedule from IS : 1570-1961</i>
i)	T215Cr12	
ii)	T105Cr1 Mn60	
iii)	T105Cr1	
iv)	T90V23	
v)	17Mn1Cr95	
vi)	20MnCr1	
vii)	C15	

Schedule VI

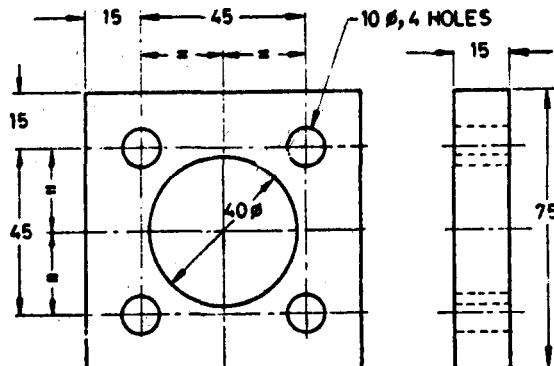
Schedule IV

Schedule II

The working surfaces shall be hardened to not less than 800 HV.

3. Dimensions

3.1 Precision Square Block — These shall be as given in Fig. 1.

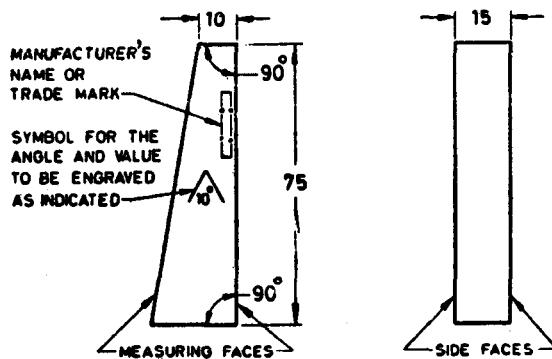


All dimensions in millimetres.

FIG. 1 PRECISION SQUARE BLOCK

Note — The precision square block is provided with a set of angle gauges for gauging a right angle.

3.2 Angle Gauges — These shall be as given in Fig. 2.



All dimensions in millimetres.

FIG. 2 ANGLE GAUGE

3.3 The recommended sets of angle gauges are as under and shall be designated as Set A:

Set A { One each of 1, 3, 9, 27 and 41 degrees
 One each of 1, 3, 9 and 27 minutes
 One each of 6, 18 and 30 seconds

3.4 An alternative set of angle gauges (designated as Set B) is given below:

Set B { One each of 1, 3, 5, 15, 30 and 45 degrees
 One each of 1, 3, 5, 20 and 30 minutes
 One each of 6, 12 and 30 seconds

Note — The above sets along with the square block enable any angle to be built up to 6 seconds, that is to within ± 3 seconds of the required angle.

4. **Tolerances** — These shall be as given below:

S/ No.	Quality	Limiting Value or Maximum Permissible Error
i)	The actual angle of each gauge including each interior angle of the precision square block shall agree with its nominal size	± 2 seconds of arc
ii)	The measuring faces shall be flat	0.25 μm
iii)	The measuring faces shall be parallel transversely (that is, each point on a line drawn across a measuring face will be at the same vertical level)	1.0 μm
iv)	The side faces shall be ground flat	2.5 μm
v)	The measuring faces shall be square to the side faces	± 30 seconds or 2.5 μm over the width 15 mm of measuring face
vi)	The surface roughness of the measuring faces shall be	0.1 μm Ra value, in accordance with IS : 3073-1967 'Assessment of surface roughness'

5. General Requirements

5.1 The angle gauges shall be suitably stabilized by any one of the established stabilizing processes.

5.2 The measuring faces shall be lapped flat to give a good wringing contact. The side faces shall be finely ground or lapped. The surface roughness of the gauging faces shall conform to the requirements given in 4. The gauging faces shall be free from corrosion marks, burrs or such other defects as would inhibit the satisfactory functioning of the surfaces. The edges shall be chamfered.

5.3 A precision square block having its four sides lapped for wringing is provided for use with the angle gauges.

5.4 A certificate giving the deviations of the angles of individual gauges from their nominal angle shall be issued with each set.

6. Designation

6.1 A set of prismatic angle gauges shall be designated by the name, the set to which it belongs and the number of this standard.

Example:

Prismatic Angle Gauge Set A, IS : 6231

6.2 The individual angle gauges shall be designated by the nominal included angle and the number of this standard.

Example:

Prismatic Angle Gauge 3 Degrees, IS : 6231

7. **Marking** — The gauges shall be marked with the following as shown in Fig. 2:

- Nominal included angle;
- Symbol for the angle (that is, \angle_{27} ; and
- Manufacturer's name or trade-mark.

7.1 ISI Certification Marking — Details available with the Indian Standards Institution.

8. Preservation and Packing

8.1 All gauges shall be protected against climatic conditions by being covered with a hard drying lanolin, or other suitable non-corrosive preparation and shall be securely wrapped in waxed paper.

8.2 Sets of gauges shall be packed in special boxes provided for the purpose, each set consisting of 13 or 15 gauges as the case may be.

EXPLANATORY NOTE

Prismatic angle gauges can be used either individually or be wrung together to form composite angles. Appendix A gives examples for building angles, using angle gauges alone and angle gauges along with precision square block.

APPENDIX A

EXAMPLES OF BUILDING ANGLES

A-1. Examples of Building Angles Using Angle Gauges

Example 1:

To build an angle : $24^\circ 10' 18''$

a) *Using Set A (see Fig. 3)*

Gauges required to obtain — $24^\circ = 27^\circ - 3^\circ$
 $10' = 9' + 1'$
 and $18'' = 18''$

Therefore the required angle is obtained by the combination of:

$(27^\circ - 3^\circ) + (9' + 1') + 18''$

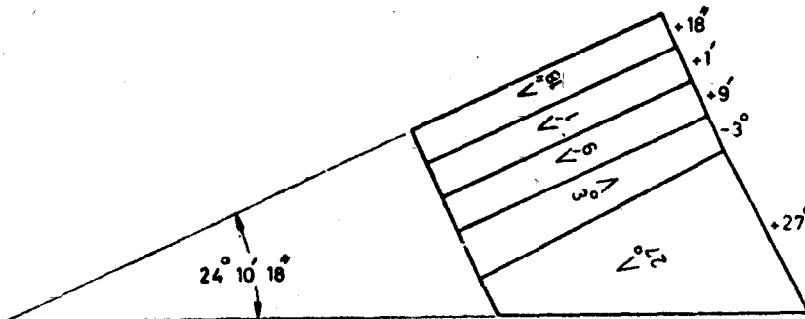


FIG. 3 BUILDING ANGLES USING ANGLE GAUGES

b) *Using Set B*

Gauges required to obtain — $24^\circ = 30^\circ - 5^\circ - 1^\circ$
 $10' = 30' - 20'$
 and $18'' = 12'' + 6''$

Hence the required angle is obtained by the combination:

$(30^\circ - 5^\circ - 1^\circ) + (30' - 20') + (12'' + 6'')$

Example 2:

To build an angle : $29^\circ 50' 9''$

a) *Using Set A*

The fraction of a degree exceeds 40', therefore the angle may be written as:
 $30^\circ - 10' + 9''$

Gauges required to build up the required angle in this case are:

$$30^\circ = 27^\circ + 3^\circ$$

$$10' = 9' + 1'$$

and $9'' = 6''$ (The nearest gauge that can be used with an error of $+3''$).

Therefore the angle = $(27^\circ + 3^\circ) - (9' + 1') + 6''$
with an error of $+3$ sec.

b) *Using Set B*

$$29^\circ = 30^\circ - 1^\circ$$

$$50' = 30' + 20'$$

and $9'' = 6''$ (The nearest gauge with an error of $+3''$).

Therefore, the angle = $(30^\circ - 1^\circ) + (30' + 20') + 6''$
with an error of $+3''$.

Note — Any angle beyond 81° in the case of Set A and 90° in the case of Set B, can be obtained by suitably using the precision square block provided along with each set.

A-2. Examples of Building Angles Using Angle Gauges Along with Precision Square Block

A B C D is the precision square block. *A B E F*, the angle gauge combination to give an angle x , is wrung on to the square block *A B C D*.

Referring to figure, if we draw normals 1, 2, 3, 4 and 5 to faces *AB*, *BC*, *CD*, *DA* and *FE*, it is seen that proceeding in a clock-wise direction the angles between normals 5 and 1 is x , between 5 and 2 it is $(90 + x)$, between 5 and 3, it is $(180 + x)$ and between 5 and 4 the angle being $(270 + x)$. Since it is possible to build angle x in increments of 6 sec. it is clear that any angle from 0 to 360° in steps of 6 sec. can be built up using the angle gauges and the precision square block.

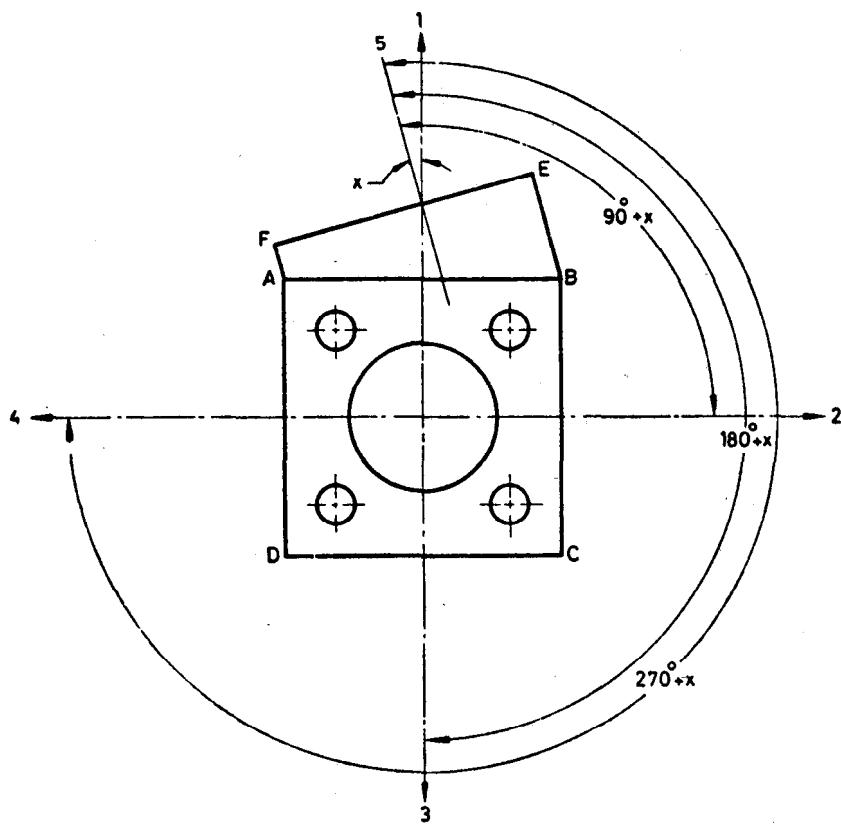


FIG. 4 USE OF PRECISION SQUARE BLOCK

Example 1:

Angle required $121^\circ 15' 27''$

The angle can be written as:

$$90^\circ + 31^\circ 15' 27''$$

Using angle gauges the angle $31^\circ 15' 27''$ is built. This combination is then wrung on to the square block and the required angle $121^\circ 15' 27''$ is obtained.

Referring to figure 4 the angle x in this case will be $31^\circ 15' 27''$ and hence the angle between normals 5 and 2 in clockwise direction will give the required angle $121^\circ 15' 27''$.

Example 2:

Angle required $306^\circ 18' 42''$

This angle can be written as:

$$270^\circ + 36^\circ 18' 42''$$

The angle $36^\circ 18' 42''$ is built up using the angle gauges and the same in combination with the square block will give the required angle.

Referring to figure 4, the angle x in this case will be $36^\circ 18' 42''$ and the angle between the normals 5 and 4 in clockwise direction will give the required angle $306^\circ 18' 42''$.